EXHIBIT 2

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS

SINGULAR COMPUTING LLC,

               Plaintiff,

     v.

GOOGLE LLC,

               Defendant.

C.A. No. 1:19-cv-12551 FDS

**GOOGLE LLC'S SECOND AMENDED ANSWER AND AFFIRMATIVE DEFENSES
TO PLAINTIFF SINGULAR COMPUTING LLC'S AMENDED COMPLAINT**

Defendant Google LLC, by and through counsel, submits its Second Amended Answer to

Plaintiff Singular Computing LLC's ("Singular") Amended Complaint ("Complaint"), as

follows:

THE PARTIES

1.   Google is without knowledge or information sufficient to form a belief as to the

truth of the allegations this paragraph, and therefore denies them.

2.   Google admits that Google LLC is a Delaware limited liability company with a

principal place of business at 1600 Amphitheatre Parkway, Mountain View, California 94043.

Google admits that more than 1,500 employees work in its Cambridge, Massachusetts office and

that its registered agent in Massachusetts is Corporation Service Company, 84 State Street,

Boston, MA 02109. Google denies any remaining allegations of this paragraph.

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JURISDICTION

3.   Google admits that this action invokes the United States patent laws, and that this

Court has subject matter jurisdiction over patent law claims. Google denies any remaining

allegations of this paragraph.

4.   Solely for the purpose of this action, Google does not contest personal jurisdiction

in this District. Google specifically denies that it has committed any acts of infringement within

the District of Massachusetts, or any other District. Google denies any remaining allegations of

this paragraph.

5.   Google admits that venue is proper in the District of Massachusetts for purposes

of this particular action but not convenient or in the interests of justice under 28 U.S.C. 1404(a).

Google denies any remaining allegations of this paragraph.

FACTUAL BACKGROUND

6.   Google is without knowledge or information sufficient to form a belief as to the

truth of the factual allegations of this paragraph, and on that basis denies them

7.   Google admits that Sergey Brin is an alumnus of Johns Hopkins Center for

Talented Youth ("CTY"). Google is without knowledge or information sufficient to form a

belief as to the truth of the remaining allegations of this paragraph, and on that basis denies them.

8.   Google is without knowledge or information sufficient to form a belief as to the

truth of the factual allegations of this paragraph, and on that basis denies them.

9.   Google is without knowledge or information sufficient to form a belief as to the

truth of the factual allegations of this paragraph, and on that basis denies them. This paragraph

also includes argument and conclusions to which no response is required, but to the extent a

response is required, Google denies the allegations.

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10.   Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and therefore denies them. This paragraph also includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations.

11.   Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and therefore denies them. This paragraph also includes argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations.

12.   Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and therefore denies them.

13.   Google admits that patent application No. 61/218,691, on its face, bears the title quoted in this paragraph and was filed in June 2009. Google denies any remaining allegations in this paragraph.

14.   Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and therefore denies them.

15.   Google admits that products such as Translate, Photos, Search, Assistant, and Gmail have become more popular over time. Google denies any remaining allegations in this paragraph.

16.   Google denies the allegations of this paragraph, including without limitation the claim of willfulness.

17.   Google admits the allegations of this paragraph.

18.   Google admits that Dr. Bates met with Google employees at least three times between June 2009 and early 2017. Google denies the remaining allegations of this paragraph.

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19.   Google admits that Dr. Bates discussed computing theory with certain Google employees. Google is without knowledge or information sufficient to form a belief as to the meaning of "such" in this paragraph, and therefore denies any related allegation in this paragraph. On information and belief, Dr. Bates never advised Google of any particular patents. Google denies any remaining allegations of this paragraph.

20.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

21.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

22.   Google admits that the screenshots excerpted in this paragraph labeled "Singular Presentations Made to Google" were provided by Dr. Bates to Google as part of his presentations to Google employees. Google admits that Jeff Dean gave a presentation titled "Machine Learning for Systems and Systems for Machine Learning," excerpts of which are reproduced in this paragraph. Google denies any remaining allegations of this paragraph.

23.   Google denies the allegations of this paragraph.

24.   Google admits that, as of 2017, it had at least eight data centers in the United States. Google denies any remaining allegations in this paragraph.

25.   Google admits that it uses some TPU devices to support some Google products. Google admits that Google's parent company, Alphabet Inc., reported worldwide net income of approximately $34 billion in 2019. Google denies any remaining allegations in this paragraph.

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26.   Google admits that it currently operates data centers in Berkeley County, South Carolina; Council Bluffs, Iowa; The Dalles, Oregon; Douglas County, Georgia; Henderson, Nevada; Jackson County, Alabama; Lenoir, North Carolina; Loudoun County, Virginia; Mayes County, Oklahoma; and Montgomery County, Tennessee. Google denies that TPUv2 and TPUv3 devices are in operation at each of these data centers. Google denies any remaining allegations in this paragraph.

THE PATENTS-IN-SUIT

27.   Google admits that United States Patent No. 8,407,273 ("the '273 patent"), on its face, bears the title quoted in this paragraph and an issuance date of March 26, 2013. Google admits that United States Patent No. 9,218,156 ("the '156 patent"), on its face, bears the title quoted in this paragraph and an issuance date of December 22, 2015. Google admits that United States Patent No. 10,416,961 ("the '961 patent"), on its face, bears the title quoted in this paragraph and an issuance date of September 17, 2019. Google denies that the '273 patent, the '156 patent, or the '961 patent were duly and legally issued. Google denies any remaining allegations of this paragraph.

28.   Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph, and therefore denies them.

29.   Google admits that provisional application No. 61/218,691, on its face, was dated June 19, 2009. Google is without knowledge or information sufficient to form a belief as to the truth of the remaining allegations in this paragraph, and therefore denies them.

PATENT ELIGIBILITY – CLAIMED ADVANCE OF REPRESENTATIVE CLAIMS

30.   Google denies the allegations of this paragraph.

'273 Patent – Representative Claim 53

31.   Google admits that Claim 53 of the '273 patent, on its face, contains the language quoted in this paragraph. Google denies any remaining allegations of this paragraph.

32.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

33.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

34.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

35.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

36.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

37.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

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38.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

39.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

40.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

41.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

42.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

43.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

44.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

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45.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

46.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

'156 Patent – Representative Claim 7

47.   Google admits that Claim 7 of the '156 patent, on its face, contains the language quoted in this paragraph. Google denies any remaining allegations of this paragraph.

48.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

49.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

50.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

51.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

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52.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

53.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

54.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

55.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

56.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

57.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

58.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

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59.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

60.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

61.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

62.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

63.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

'961 Patent – Representative Claim 4

64.   Google admits that Claim 4 of the '961 patent, on its face, contains the language quoted in this paragraph. Google denies any remaining allegations of this paragraph.

65.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

66.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

67.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

68.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

69.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

70.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

71.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

72.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

73.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

74.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

75.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

76.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

77.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

78.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

79.   This paragraph sets forth argument and legal conclusions to which no response is required. To the extent this paragraph includes any allegations to which a response is required, Google denies them.

80.   Google denies the allegations of this paragraph.

COUNT I (GOOGLE'S INFRINGEMENT OF U.S. PATENT NO. 8,407,273)

81.   Google incorporates by reference its responses to the allegations of paragraphs 1 to 80 above as its response to this paragraph.

82.   Google admits that the '273 patent, on its face, contains the statement that "today's CPU chips make inefficient use of their transistors." Google denies any additional allegations of this paragraph.

83.   Google admits that the '273 patent, on its face, refers to "LPHDR execution unit[s]." This paragraph also includes argument and legal conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

84.   This paragraph contains argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

85.   This paragraph contains argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

86.   This paragraph contains argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

87.   Google admits that the language quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

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88.   Google admits that Claim 53 of the '273 patent, on its face, contains the language quoted in this paragraph. Google denies any remaining allegations of this paragraph.

89.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

90.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. The term arithmetic logic (ALU) unit is not defined and thus vague, and Google denies all allegations referencing ALUs on that basis and Google further denies those allegations to the extent they incorporate a legal conclusion about what constitutes an ALU. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

91.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

92.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

93.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies that the Wikipedia entry for Single-precision floating-point format, reproduced in this paragraph, was originally

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"published by Google." Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

94. Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph regarding "Singular test results," and therefore denies them. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

95. Upon information and belief, Google denies that it "published" the image titled "TPUv2 Block Diagram." Google admits that the remaining language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google admits that Dr. David Patterson presented a lecture at the MIT Computer Science and Artificial Intelligence lab on October 16, 2019. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

96. Google admits that the language quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

97. Google denies the allegations of this paragraph.

COUNT II (GOOGLE'S INFRINGEMENT OF U.S. PATENT NO. 9,218,156)

98. Google incorporates by reference its responses to the allegations of paragraphs 1 to 97 above as its response to this paragraph.

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99.   Google admits that the '156 patent, on its face, contains the statement that "today's CPU chips make inefficient use of their transistors." Google denies any additional allegations of this paragraph.

100.   Google admits that the '156 patent, on its face, refers to "LPHDR execution unit[s]." This paragraph also includes argument and legal conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

101.   This paragraph contains argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

102.   This paragraph contains argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

103.   This paragraph contains argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

104.   Google admits that the language quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

105.   Google admits that Claim 7 of the '156 patent, on its face, contains the language quoted in this paragraph. Google denies any remaining allegations of this paragraph.

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106.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

107.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. The term arithmetic logic (ALU) unit is not defined and thus vague, and Google denies all allegations referencing ALUs on that basis and Google further denies those allegations to the extent they incorporate a legal conclusion about what constitutes an ALU. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

108.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

109.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

110.   Google denies that the Wikipedia entry for Single-precision floating-point format, reproduced in this paragraph, was "published by Google." Google admits that the remaining language and images quoted in this paragraph as being "published by Google" appeared on a Google website.   Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

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111.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website.   The term "float32 format" is not defined and thus vague, and Google denies all allegations referencing float32 format on that basis. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph regarding "Singular test results," and therefore denies them. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

112.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on Google websites. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

113.   Google admits that each TPUv2 has 8 MXUs and each TPUv3 has 16 MXUs. Google admits that Dr. David Patterson presented a lecture at the MIT Computer Science and Artificial Intelligence lab on October 16, 2019. Upon information and belief, Google denies that it "published" the image titled "TPUv2 Block Diagram." Google admits that the remaining language and images quoted in this paragraph as being "published by Google" appeared on a Google website.   Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

114.   Google admits that the language reproduced in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

115.   Google denies the allegations of this paragraph.

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COUNT III (GOOGLE'S INFRINGEMENT OF U.S. PATENT NO. 10,416,961)

116.   Google incorporates by reference its responses to the allegations of paragraphs 1 to 115 above as its response to this paragraph.

117.   Google admits that the '961 patent, on its face, contains the statement that "today's CPU chips make inefficient use of their transistors." Google denies any additional allegations of this paragraph.

118.   Google admits that the '961 patent, on its face, refers to "LPHDR execution unit[s]." This paragraph also includes argument and legal conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

119.   This paragraph contains argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

120.   This paragraph contains argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

121.   This paragraph contains argument and conclusions to which no response is required, but to the extent a response is required, Google denies the allegations. Google denies any additional allegations of this paragraph.

122.   Google admits that the language quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

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123.   Google admits that Claim 4 of the '961 patent, on its face, contains the language quoted in this paragraph. Google denies any remaining allegations of this paragraph.

124.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

125.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. The term arithmetic logic (ALU) unit is not defined and thus vague, and Google denies all allegations referencing ALUs on that basis and Google further denies those allegations to the extent they incorporate a legal conclusion about what constitutes an ALU. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

126.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

127.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

128.   Google denies that the Wikipedia entry for Single-precision floating-point format, reproduced in this paragraph, was "published by Google." Google admits that the remaining language and images quoted in this paragraph as being "published by Google" appeared on a

Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

129.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on a Google website. The term "float32 format" is not defined and thus vague, and Google denies all allegations referencing float32 format on that basis. Google is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph regarding "Singular test results," and therefore denies them. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

130.   Google admits that the language and images quoted in this paragraph as being "published by Google" appeared on Google websites. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

131.   Google admits that the language reproduced in this paragraph as being "published by Google" appeared on a Google website. Google denies the remaining allegations in this paragraph as they relate to Google, and specifically denies that it has committed any acts of infringement.

132.   Google denies the allegations of this paragraph.

PRAYER FOR RELIEF

These paragraphs set forth the statement of relief requested by Singular to which no response is required. Google denies any allegations contained in the Prayer for Relief to which a response is required, including without limitation the claim of willfulness.

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Google denies each and every allegation of Singular's complaint not specifically admitted or otherwise responded to above. Google specifically denies that it has infringed or is liable for infringement of any valid and enforceable patent claims of Singular. Google further specifically denies that Singular is entitled to any relief whatsoever of any kind against Google as a result of any act of Google or any person or entity acting on behalf of Google.

DEMAND FOR JURY TRIAL

Singular's demand for a trial by jury for all counts of the complaint does not state any allegation, and Google is not required to respond. To the extent that any allegations are included in the demand, Google denies these allegations.

GOOGLE'S AFFIRMATIVE DEFENSES

Google asserts the following affirmative defenses. To the extent any of the defenses, in whole or in part, relates to or negates an element of Singular's claims, Google in no way seeks to relieve Singular of its burden of proof or persuasion on that element. All defenses are pled in the alternative and do not constitute an admission of liability or that Singular is entitled to any relief whatsoever. Google reserves any and all rights it has under the Federal Rules of Civil Procedure to assert additional defenses and/or counterclaims as additional facts are learned or present themselves during discovery or otherwise during the course of these proceedings.

First Affirmative Defense – Invalidity and/or Non-Patentability (All Counts)

1.   The claims of the Patents-in-Suit are invalid and unenforceable for failure to satisfy one or more of the requirements of Title 35 of the United States Code, including without limitation 35 U.S.C. §§ 101, 102, 103, and 112, because the claims are directed to abstract ideas or other non-statutory subject matter, because the claims lack novelty, and are taught and

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suggested by the prior art, because the claims are obvious in view of the prior art, and because the claims suffer from a failure of written description, lack of enablement, and claim indefiniteness.

Second Affirmative Defense – Estoppel (All Counts)

2.   Plaintiff's claims are barred, in whole or in part, by the doctrines of equitable estoppel and/or prosecution history estoppel.

Third Affirmative Defense – Laches (All Counts)

3.   The relief sought by Singular is barred, in whole or in part, by the equitable doctrine of laches.

Fourth Affirmative Defense – Substantial Non-Infringing Uses (All Counts)

4.   Any and all products or actions accused of infringement by Singular have substantial uses that do not infringe and do not induce or contribute to the alleged infringement of the claims of the Patents-in-Suit.

Fifth Affirmative Defense – Limitation on Patent Damages (All Counts)

5.   Singular's claim for damages, if any, against Google for alleged infringement of the Patents-in-Suit are limited by 35 U.S.C. §§ 286, 287 and/or 288, and by the territorial limits of the United States patent laws.

Sixth Affirmative Defense – Equitable Relief Unavailable (All Counts)

6.   Singular is barred from obtaining any equitable relief from Google because any alleged injury to Singular is neither immediate or irreparable, Singular has an adequate remedy at law, and granting equitable relief would not be in the public interest.

**Seventh Affirmative Defense – Damages Speculative, Uncertain, and Contingent
(All Counts)**

7.   Singular's alleged damages are speculative, uncertain and/or contingent, have not

accrued, and are not recoverable.

Eighth Affirmative Defense – No Injury (All Counts)

8.   Singular's claims are barred, in whole or in part, because Singular has not

suffered any injury in fact from the conduct alleged in the Complaint.

Ninth Affirmative Defense – No Causation (All Counts)

9.   Google's conduct was and is neither the cause in fact nor the proximate cause of

any injury, loss, or damage alleged by Singular.

Tenth Affirmative Defense - 28 U.S.C. § 1498 (All Counts)

10.   To the extent Plaintiffs' allegations of infringement include any method, system,

apparatus and/or product used by or manufactured by or for the United States, Plaintiffs' claim

for damages for alleged infringement is limited and/or barred by 28 U.S.C. § 1498.

**Eleventh Affirmative Defense – Inequitable Conduct/Fraud on the Patent Office
('156 and '961 Patents)**

11.   The '156 and '961 patents are unenforceable due to the inequitable conduct of the

named inventor of the patents, Dr. Joseph Bates. Dr. Bates was directly involved in the filing

and prosecution of the applications leading to the issuance of the '156 and '961 patents that are

asserted by Singular against Google in this case.

12.   Dr. Bates knew of at least two material prior art publications demonstrating public

use of the claimed inventions under at least Singular's implicit claim interpretations advanced in

this proceeding. With specific intent to deceive, Dr. Bates withheld these publications from the

United States Patent and Trademark Office (the "Patent Office") during the prosecution of the

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'156 and '961 patents. The Patent Office would not have allowed one or more claims of the '156

and '961 patents had it been aware of the withheld prior art.

13.   The prior art that Dr. Bates failed to disclose to the Patent Office during the

prosecution of the '156 and '961 patents include at least the following publications, which also

disclosed public uses that are "but/for" material to at least one claim of both patents: ████

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14.   Dr. Bates and his prosecution counsel, Robert Plotkin, filed the application

leading to the '156 patent on March 25, 2013. Both Dr. Bates and Plotkin were involved in

prosecuting the application leading to the '156 patent and had a duty to disclose to the Patent

Office all information known to them to be material to patentability. That duty continued

throughout the pendency of all claims in the application leading to the '156 patent.

15.   The Patent Office did not issue the '156 patent until December 22, 2015.

Between March 25, 2013, and December 22, 2015, Dr. Bates and Plotkin had at least the right

and opportunity to comment on, and suggest changes to, the application leading to the '156

patent. Dr. Bates and Plotkin submitted at least one information disclosure statement during the

pendency of the claims—on August 18, 2013—purporting to identify references pursuant to their

ongoing duty to disclose all information known to them to be material to patentability.

16.   Dr. Bates and his prosecution counsel Plotkin filed the application leading to the '961 patent on October 30, 2018. Both Dr. Bates and Plotkin were involved in prosecuting the application leading to the '961 patent and had a duty to disclose to the Patent Office all information known to them to be material to patentability. That duty continued throughout the pendency of all claims in the application leading to the '961 patent.

17.   The Patent Office did not issue the '961 patent until September 17, 2019. Between October 30, 2018, and September 17, 2019, Dr. Bates and Plotkin had at least the right and opportunity to comment on, and suggest changes to, the application leading to the '961 patent. Dr. Bates and Plotkin submitted at least one information disclosure statement during the pendency of the claims—on January 25, 2019—purporting to identify references pursuant to their ongoing duty to disclose all information known to them to be material to patentability. Dr. Bates and Plotkin were also aware of the duty to disclose material references they had knowledge of prior to filing the application.

18.   On information and belief, Dr. Bates deliberately withheld material prior art that he knew of and he instead selectively disclosed only certain, potentially less relevant prior art information. The extent of this decision to withhold was not evident to Google until the last week of fact discovery, when both Dr. Bates and Plotkin were deposed on the last day of discovery at Singular's behest. Specifically, that deposition testimony combined with the documentary evidence demonstrates that Dr. Bates deliberately withheld material prior art references—

██████████████████████████—from the Patent Office.

Dr. Bates's Decision to Withhold Material Prior Art

19.   Dr. Bates cultivated ignorance regarding prior art and disregarded numerous warnings that material information or prior art may exist.

20.   Plotkin conducted two prior art searches for the application that lead to the United States Patent No. 8,150,902 ("the '902 Patent"). ████████████████████████ ████████████████████ Based on information and knowledge, both searches occurred prior to June 15, 2010, when the application leading to the '902 patent was filed.

██ ░░ The '961 and '156 patents resulted from continuations of the application that issued as the '902 patent; respectively, they were filed three years and eight years later. Plotkin testified at his deposition that █████████████████████████████

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████████████████████████ When asked if it was Plotkin's practice to conduct prior art searches before filing a patent application, he replied █████████████████████

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████████████████████████ Although Plotkin submitted new references in connection with the applications that led to the '961 and '156 patents, ██████

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24.   ██

████████████████████████████ Thus, counsel for Google also asked Dr. Bates whether he

ever provided copies of prior art to Plotkin. ████████████████████████████████

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26.   Dr. Bates knew of the existence of specific prior art references but chose not to

disclose them to the Patent Office, despite his knowledge that prior art was material.

Dr. Belanović's Thesis and the Parameterized Floating-Point Library

27.   In filing the '961 and '156 patents, Dr. Bates purported to have invented FPGAs

that Singular contends execute operations with low precision and a high dynamic range, under at

least Singular's implicit claim interpretations advanced in this proceeding. In the common specification between the patents-at-issue, Dr. Bates alleged that "modern FPGAs often devote a significant portion of their area to providing dozens or hundreds of multiplier blocks, which can be used instead of general purpose resources for computations requiring multiplication." He then dismissed these "modern FPGAs" because their "multiplier blocks typically perform 18 bit or wider integer multiplies."

28.   But Dr. Bates knew that prior to his claimed inventions, others had programmed FPGAs to use custom floating-point formats, including 16-bit formats that Singular contends infringe the claims of the '961 and '156 patents.

29.   Dr. Pavle Belanović was a master's student at Northeastern University in Boston in 2002. His thesis advisor was Dr. Miriam Leeser, Professor of Electrical and Computer Engineering at Northeastern University, who specializes in the application of field-programmable gate arrays (FPGAs) to advance machine learning.

30.   In 2002, Drs. Belanović and Leeser co-authored an article titled "A Library of Parameterized Floating-Point Modules and Their Use." In it, they noted an inherent concept in computing: "[a] natural tradeoff exists between smaller bitwidths requiring fewer hardware resources and higher bitwidths providing better precision. Also, within a given total bitwidth, it is possible to assign various combinations of bitwidths to the exponent and fraction fields, where wider exponents result in higher range and wider fractions result in better precision." Drs. Belanović and Leeser recognized that custom floating-point formats were an inevitable outgrowth of such an understanding, because "[r]educed bitwidth implementations require fewer resources and thus allow for more parallel implementations."

31.   Using Wildstar reconfigurable architecture and a Xilinx XCV1000 FPGA, Drs.

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Belanović and Leeser implemented custom floating-point formats. The custom floating-point

formats included multiple 16-bit and 12-bit formats that Singular contends infringe the claims of

the '961 and '156 patents.

32.   Drs. Belanović and Leeser then created the Parameterized Floating-Point Library

for use with reconfigurable hardware, a publicly available library for anyone to implement

custom formats for FPGAs, including the formats in the ranges Singular contends meet the '961

and '156 patents' claims. The Parameterized Floating-Point Library has been available for

public use since 2002 and is still available for use now.

33.   Dr. Belanović's Thesis describes how, in 2002, Dr. Belanović, under Dr. Leeser's

guidance, applied those custom floating-point formats in experiments using the Wildstar

architecture and Xilinx VIRTEX XCV1000 FPGAs. Dr. Belanović implemented a system that

included 255 multiplication execution units. These experiments also included 12-bit and 16-bit

formats from the Parameterized Floating-Point Library that Singular contends meet Dr. Bates'

claimed error rates and dynamic ranges.

34.   Dr. Belanović's Thesis explains how Dr. Belanović chose custom floating-point

formats implemented through an FPGA for the same reason Dr. Bates later described in his

alleged inventions: "When using floating-point arithmetic, the designer using the library has full

control to trade off between range and precision. . . . With a wider exponent field, the designer

provides larger range to the signal, while sacrificing precision. Similarly, to increase the

precision of a signal at the cost of reduced range, the designer chooses a narrower exponent and

wider fraction field." Dr. Belanović noted that "[r]educing datapath bitwidths to their optimal

values enables design of more parallel architectures and implementation of larger designs."

35.   Dr. Belanović recognized that applications of his research included machine

learning, such as "algorithms that are highly parallel and have signal values that have a high

enough range to require floating-point representation, yet are tolerant enough to accommodate its

lower precision." Dr. Belanović noted that parallel processing was the obvious conclusion of his

custom format research: "the range and precision required will ideally necessitate bitwidths

significantly lower than those of the IEEE formats, so that higher parallelism may be achieved."
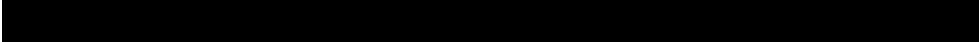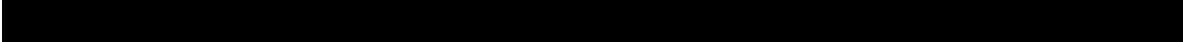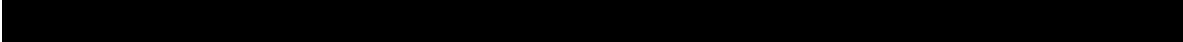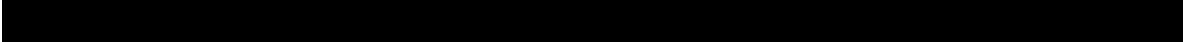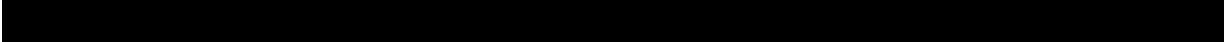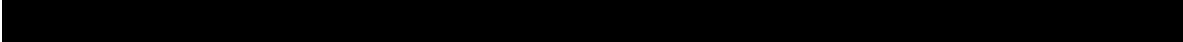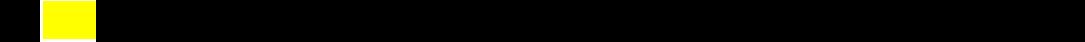
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43.   Google has relied on both references in its invalidity contentions, which show that

Dr. Bates' claims lack novelty and were obvious to those skilled in the art.

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44.   The file histories for the '961 and '156 patents do not include Dr. Belanović's

Thesis or Drs. Leeser and Belanović's Parameterized Floating-Point Library. The Patent Office

did not issue the '156 patent until December 22, 2015, almost two years after February 2014, the

latest point at which Dr. Bates definitively knew of the materiality of Dr. Belanović's Thesis and

the Parameterized Floating-Point Library. Neither Dr. Bates nor Plotkin disclosed either prior art

reference to the Patent Office while the application leading to the '156 patent was pending or in

the application leading to the '961 patent.

45.   Both the prior publication and the prior use constitute material prior art and would

not have been cumulative of other information already on record with the Patent Office. Either

piece of prior art alone, or in combination with the knowledge of a person of ordinary skill in the

art, or in combination with other prior art, discloses or suggests each and every element of, and

anticipates or renders obvious each claim of the '961 and '156 patents, at least under the implicit

claim construction positions advanced by Singular. Had the Patent Office known this, the two

patents would not have been issued.

The Coleman Article and the Logarithmic Microprocessor

46.   In filing the '961 and '156 patents, Dr. Bates purported to have invented a

logarithmic embodiment of his low-precision, high dynamic range execution unit. In fact, in the

common specification for all three asserted patents, Dr. Bates characterizes this logarithmic

embodiment as superior to the embodiment using a floating-point format.

47.   Dr. Bates knew that prior to the claimed inventions, others had disclosed the

ability to use low precision, high dynamic-range execution units to perform arithmetic operations

on logarithmic representations, at least as understood under Singular's implicit claim

interpretations advanced in this proceeding.

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53.   The file histories for the '961 and '156 patents do not include any reference to the

██   The Patent Office did not issue the '156 patent

until December 22, 2015, over a year after September 2014, the latest point at which Dr. Bates

definitively knew of the materiality of the ██

Neither Dr. Bates nor Plotkin disclosed either prior art reference to the Patent Office while the

application leading to the '156 patent was pending or in the application leading to the '961

patent.

54.   Both the prior publication and the prior use constitute material prior art and would

not have been cumulative of other information already on record with the Patent Office. Either

piece of prior art alone, or in combination with the knowledge of a person of ordinary skill in the

art, or in combination with other prior art, discloses or suggests each and every element of, and

anticipates or renders obvious each claim of the '961 and '156 patents, at least under Singular's

implicit claim construction positions. Had the Patent Office known this, the two patents would

not have been issued.

55.   The '961 and '156 patents are unenforceable because of the inequitable conduct

during their prosecution by Dr. Bates.

EXCEPTIONAL CASE

On information and belief, this is an exceptional case entitling Google to an award of its

attorneys' fees incurred in connection with defending this action pursuant to 35 U.S.C. § 285, as

a result of, inter alia, Plaintiff's assertion of the Patents-in-Suit against Google with the

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knowledge that Google does not infringe any valid or enforceable claim of the Patents-in-Suit and/or that the Patents-in-Suit are invalid and/or unenforceable.

PRAYER FOR RELIEF

WHEREFORE, Google respectfully requests the Court to enter judgment in its favor and against Singular as follows:

a.   For a judgment dismissing Singular's Amended Complaint against Google with prejudice; and

b.   For a judgment that the Patents-in-Suit, and every asserted claim thereof, are not infringed, invalid, and unenforceable;

c.   For an order that Google is the "prevailing party" with respect to Singular's patent claims and that this case is "exceptional" within the meaning of 35 U.S.C. § 285, and for an award granting Google its reasonable attorney's fees and costs, as permitted by law or equity;

d.   A judgment limiting or barring Plaintiff's ability to enforce the Patents-in-Suit in equity;

e.   Such other and further relief as this Court may deem just and proper.

JURY DEMAND

Google hereby demands a jury trial for all issues so triable.

Respectfully submitted,

Dated: ███████████

By: */s/ DRAFT* _____

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